CHAPTER 6 ENERGY FOR MARINE TRANSPORTATION

6.1 Marine Transportation and Hawaii

In the previous chapter, interisland air transportation of passengers was described as analogous to a Mainland intrastate highway system. In a similar manner interisland marine shipping is the analog of Mainland intrastate trucking, pipelines, and railroads. Interisland vessels, primarily towed barges, transport most of Hawaii's cargo among islands.

Transportation of cargo from the Mainland and overseas is primarily seaborne. The only alternative is air cargo, with its inherent cost, and limits on weight and bulk. Air cargo is primarily used for high-value, time-sensitive, or perishable items.

6.2 Marine Transportation Energy Demand

6.2.1 Current Marine Fuel Use

Most fuel used or sold in the marine transportation category was bonded fuel for use in international shipping or international fishing operations or was loaded as cargo and exported from Hawaii. In 1997, such bonded fuel included 1.813 million barrels of residual fuel oil and 1.778 million barrels of diesel fuel oil. Sales for interisland use were 130,742 barrels of residual fuel oil, 235,598 barrels of diesel, and 997 barrels of gasoline (DBEDT 1999). Table A.18, in Appendix A, provides available data on marine fuel use from 1990 to 1997.

6.2.2 Future Marine Fuel Requirements

There was little information upon which to base an estimate of future marine fuel use. Much of the overseas fuel business was from foreign fishing vessels, and this varied based upon their activity and the relative price of fuel at alternative bunkering ports. To provide a very rough estimate, marine fuel use was modeled in the ENERGY 2020 model to grow at the rate of population growth. Figure 6.1 depicts the ENERGY 2020 estimate based upon this assumption.

6.3 Greenhouse Gas Emissions from Marine Fuel Use

In-state uses of marine fuels contributed about 150,400 tons CO_2-equivalent to Hawaii's greenhouse gas emissions. Table A-18 summarizes estimated greenhouse gas emissions from marine fuels from 1990 to 1997. Based upon estimates produced by the ENERGY 2020 model, Figure 6.2 depicts estimated CO_2 emissions from in-state marine fuel use from 2000 to 2020.

The ENERGY 2020 model predicts year 2010 emissions at about 208,000 tons of CO_2, or 33% above the Kyoto target of 139,875 tons by the years 2008–2010. The estimated emissions for 2020 were 238,000 tons, 41% above the target. The Kyoto target is provided as a reference and neither the marine sector, nor any other sector, nor any individual state is likely to be expected to independently meet it should it be ratified.

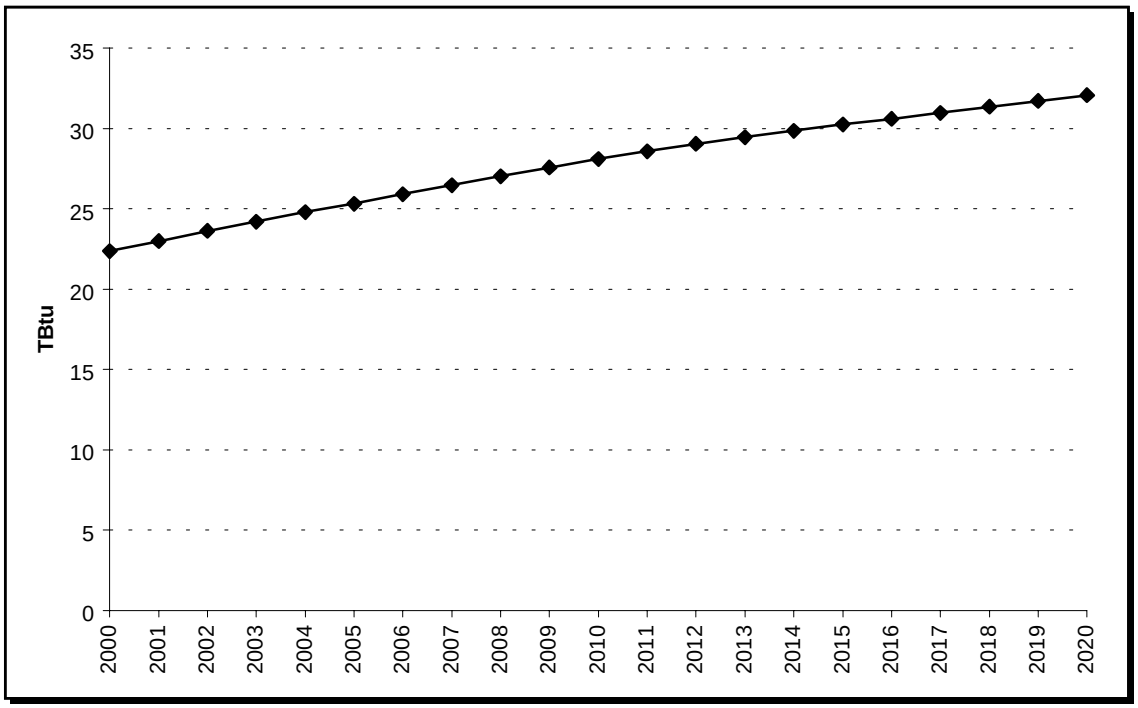

Figure 6.1 Estimated Marine Fuel Sold or Distributed in Hawaii, 2000–2020

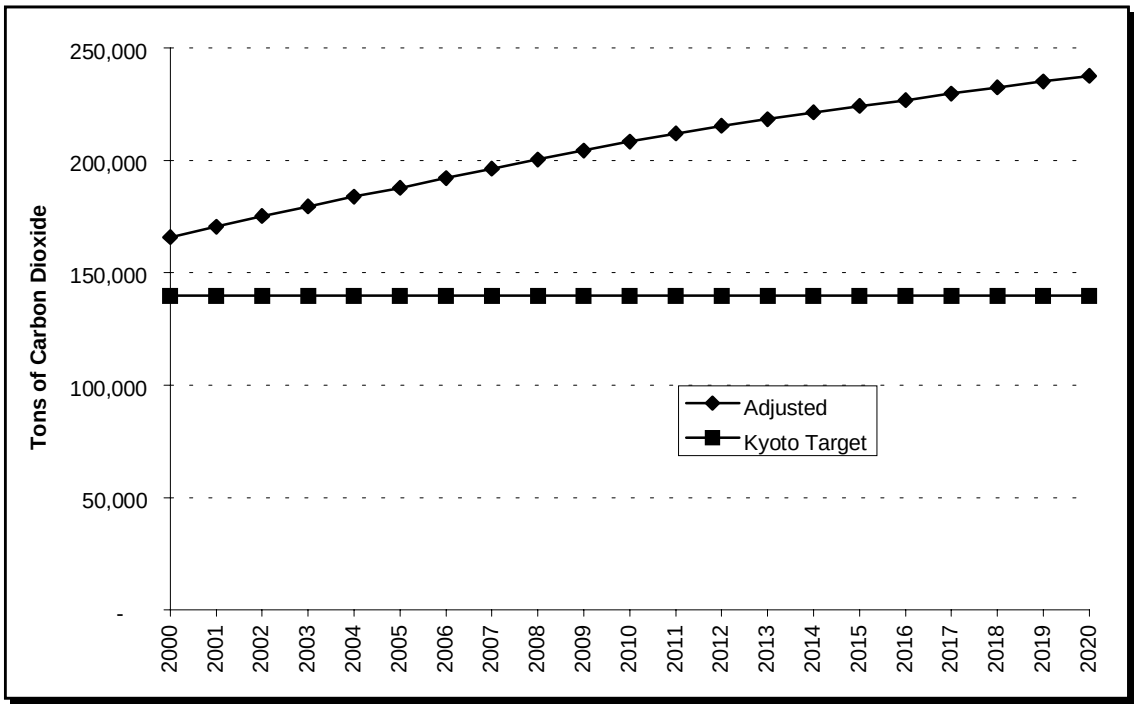

Figure 6.2 Estimated CO_2 Emissions from Hawaii Domestic Marine Fuel Use, 2000–2020

6.4 Reducing Marine Transportation Energy Requirements

6.4.1 Recommendations for Reducing Marine Fuel Use

6.4.1.1 RECOMMENDATION: Consider Changes in Operating Procedures for Energy Efficiency

Suggested Lead Organizations: Shipping Companies

Improvements in operating procedures could save energy. Examples include the following:

- Require crew training in efficient operations;
- Create financial incentives for fuel-efficient operations (Argonne National Laboratory, 1991, cited in PBQD 1995);
- Perform regular propeller maintenance (estimated reduction in fuel use, 5% or more);
- Use anti-fouling paint to ensure hull smoothness and reduce drag (estimated reduction in fuel use, 3–4%);
- Route ships to avoid heavy weather (estimated reduction in fuel use, 4%);
- Reduce average speed 10% (estimated 5% reduction in fuel use for older vessels); and
- Use adaptive autopilots (estimated reduction in fuel use, 2.5%) (Michaelis 1997b, 22).

6.4.1.2 RECOMMENDATION: Adopt Technical Improvements to Ships

Suggested Lead Organizations: Shipping Companies

A number of technical improvements that would also save energy could be made to future ships engaged in overseas trade or interisland operations.

- Replacement of two-stroke diesel engines with modern four-stroke diesels would reduce fuel consumption by 5 to 10 % or more;
- Replacing existing engines with less powerful ones could also achieve energy savings since diesels operate most efficiently at full power, and marine engines typically operate well below full power;
- New engine technologies such as turbo-compounding and rankine bottoming cycles have demonstrated fuel savings of 5 to 7 % and 12 %, respectively (PBQD 1995);
- Improved hull form on new ships could reduce fuel use up to 3%;
- Improved propeller designs could save small amounts of fuel;
- Wind assistance through installation of auxiliary sails could reduce fuel use by 10–20%;

- Doubling ship size for similar routes could save up to 30% of the fuel otherwise used by two ships of the current size;
- Fuel switching to biofuels could save up to 80% in greenhouse gas emissions compared with a similar fossil-fueled ship (Michaelis 1997b, 22).

6.4.1.3 RECOMMENDATION: Ensure That Proposals for Carbon Taxes on Marine Transportation Fuels Do Not Adversely Affect Hawaii

Suggested Lead Organizations: Hawaii Congressional Delegation and Legislature

As noted in the section on air transportation, carbon taxes are often discussed as potential measures for reducing fossil fuel use and greenhouse gas emissions. They would accomplish this by increasing the cost of using fossil fuel. As the Expert Group study notes, "a carbon charge on bunker fuel would only be feasible, fair and economically efficient in a context where such a charge is globally imposed, and where other transport modes pay their full social costs" (Michaelis 1997b, 6).

For Hawaii, the major likely effect would be increased costs for goods brought in by ship from overseas and those shipped interisland. Increases in efficiency could lag the imposition of the tax by many years due to the long life of ships in service. Consequently, use of a carbon tax on marine transportation fuel is *not* recommended. Should such a tax be enacted nationally, Hawaii should be exempted due to the lack of alternatives.